

From: **Robert Van Buskirk** rdvanbuskirk@gmail.com  
Subject: Re: Tec experiment  
Date: March 31, 2018 at 11:47 AM  
To: Peter V. Schwartz pschwartz@calpoly.edu

RV

Just a quick update.

I did a brief test on the TEC pot. I was able to raise the water temperature from around 20 deg C to above 50 deg C at an efficiency of around 90%.

The side and top of the pot were uninsulated. I suspect that I will be able to get it up to somewhere in the range of 110% to 130% with a little more work (like careful insulation of the pot).

My general philosophy on economic optimization with TECs is that if the investment in TECs can increase heating power at an incremental cost of \$1/watt or less (where watt is incremental heating power of the TEC relative to the diode heater that consumes the same amount of solar electricity, and the dollar is the incremental cost of the TEC compared to the diode that consumes the same energy). If the extra TEC heating power is below \$1/watt, then the cost of the TEC can be paid for by using a smaller solar panel for the same amount of heating power delivered.

An example of how this might work is that the diode pot might deliver 60 watts of heating at 90% efficiency at a cost of about \$3 in diodes consuming 67 watts of power.

For that same 67 watts of consumption, the TECs might deliver 80 watts of heating at 120% efficiency. If the cost of the TECs can be kept to  $\$20 + \$3 = \$23$  or less then the TECs can be economical. If not, then they are more expensive than just adding more panel.

Because the diodes are so damn cheap, I suspect that over the long term, it will be most economical to just add more panel and diodes to get faster heating rates if needed.

But there are two additional features of the TEC pots that might make them worth the extra cost.

The first is that it may be able to get the TEC pots to heat the water faster, by putting them on a small fire. When you do this, the TECs will take the heat from the fire and move it to the contents of the pot, heating up the food at a faster rate. So people can get fast cooking if they want. It makes the pot more versatile.

And the second thing, is that it might be possible to reverse the voltage on the TECs and turn the pot into a water cooler. This way people can have cold drinks on a hot day.

I will probably test those two concepts when I am in Malawi next month.

-RVB

On 3/30/2018 2:26 PM, Peter V. Schwartz wrote:

Sorry,, with a closer look, I see that it is in F.

Pete

Pete Schwartz  
Cal Poly Physics, Sustainability  
the new science building, 180-608  
805-756-1220  
[pschwartz@calpoly.edu](mailto:pschwartz@calpoly.edu)

[My Faculty Webpage](#)  
[Our Research](#)  
[My Resume](#)  
[My Classes using open source videos](#)

On Mar 30, 2018, at 2:24 PM, Peter V. Schwartz <[pschwartz@calpoly.edu](mailto:pschwartz@calpoly.edu)> wrote:

Robert,

I presume this is reading in Fahrenheit?

PEte

Pete Schwartz  
Cal Poly Physics, Sustainability  
the new science building, 180-608  
805-756-1220  
[pschwart@calpoly.edu](mailto:pschwart@calpoly.edu)

[My Faculty Webpage](#)  
[Our Research](#)  
[My Resume](#)  
[My Classes using open source videos](#)

On Mar 30, 2018, at 10:02 AM, Robert Van Buskirk <[rdvanbuskirk@gmail.com](mailto:rdvanbuskirk@gmail.com)> wrote:

I will review the website over the weekend.

On Fri, Mar 30, 2018, 9:59 AM Peter V. Schwartz <[pschwart@calpoly.edu](mailto:pschwart@calpoly.edu)> wrote:

Robert,

I've updated the website for the [spring class](#). Please take a look at it. Let me know if you'd change anything. I have lots of upgrades to make, but I have to go to a meeting now about what Cal Poly wants to do as Diablo closes, so I probably won't be back online for the day.

Thanks for being so incredibly on this stuff and supplying a constant flow of support, information, and questions.

Pete

Pete Schwartz  
Cal Poly Physics, Sustainability  
the new science building, 180-608  
805-756-1220  
[pschwart@calpoly.edu](mailto:pschwart@calpoly.edu)

[My Faculty Webpage](#)  
[Our Research](#)  
[My Resume](#)  
[My Classes using open source videos](#)

On Mar 30, 2018, at 9:56 AM, Robert Van Buskirk <[rdvanbuskirk@gmail.com](mailto:rdvanbuskirk@gmail.com)> wrote:

Since there are potentially so many projects, I will send what I am trying with some diodes that are rated to 10 to 30 amps. And I will send the diode specs.

At volume, these new diodes will come out at \$0.10/watt of heating power on average I think.

-RVB

On Fri, Mar 30, 2018, 9:47 AM Peter V. Schwartz <[pschwart@calpoly.edu](mailto:pschwart@calpoly.edu)> wrote:

Robert,

Very good. I will put a group of students on this project for the [spring class](#) starting this coming Monday? I'm just now building out the projects on the website. Wow! We have 37 students enrolled in the class now! We can support 8 or 9 projects. I think there's some graduate students signed up too.

Pete

Pete Schwartz  
Cal Poly Physics, Sustainability  
the new science building, 180-608  
805-756-1220  
[pschwart@calpoly.edu](mailto:pschwart@calpoly.edu)

[My Faculty Webpage](#)  
[Our Research](#)  
[My Resume](#)  
[My Classes using open source videos](#)

On Mar 30, 2018, at 9:41 AM, Robert Van Buskirk <[rdvanbuskirk@gmail.com](mailto:rdvanbuskirk@gmail.com)> wrote:

Here is what happens when you use Tec's as pot heaters. I put four sets of three on series, and ran them at 5.5V each. They maintained a 50 to 60 degree F difference between top and bottom (i.e outside and pot).

I think this means, you get a little heat pumping, when the water temperature in the pot is less than 55 degrees higher than ambient. For Africa this should give you a water heater that can be greater than 100% efficiency when the water temperature is less than 135 deg. F (80 + 55). How much greater than 100% depends on the efficiency of heat transfer in to the cold side of the thermoelectric chip.

The TEC chips can be purchased for less than \$3 each. I think the academic journals would enjoy a paper on a \$50, >100% efficient solar electric hot water pot for decreasing wood burning in rural Africa. Even, if it is only %110 efficient, the >100% bit should have a little wow factor to it.

-RVB  
<20180330\_092022.jpg>

